

## R E M A R K S

Original claims 1, 7-11, 15-18, and 29-31 remain in the case. Applicants respectfully traverse the Examiner's Final Rejection and submit the following response.

### The Rejection of Claims 1, 7-11, 15-18, and 29-31 under 35 U.S.C. 103(a)

Claims 1, 7-11, 15-18, and 29-31 stand rejected as obvious over Miller et al. (U.S. Patent 6,518,473) in view of either U.S. Patent 5,672,795 (hereafter referred to as "Vora et al.") or U.S. Patent 5,271,835 (hereafter referred to as "Gorawara et al."). The Final Office Action notes that Miller discloses an oligomerization (dimerization) process by feeding an olefinic feed, which derives from Fischer-Tropsch synthesis, into an adsorption zone to remove oxygenates. The treated feed is then contacted with an ionic liquid catalyst in a dimerization zone to produce a product having a higher average molecular weight and increased branching as compared to the olefinic feed. The product can be used as lubricating base oil and diesel. Miller discloses that the olefinic feed is dehydrated to produce a pure olefinic feed. Miller also discloses a step of hydrogenation of diolefins. Miller, however, does not disclose that the adsorption zone comprises zeolitic molecular sieve, such as 13X zeolite.

Both secondary references disclose separating oxygenates from a hydrocarbon feed by using an X-zeolite. The Final Office Action indicates that since the zeolite of both Vora and Gorawara is the same as the claimed zeolite, the zeolite of Vora and Gorawara would have the characteristics as claimed.

The Final Office Action states that it would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the process of Miller by using the zeolite of either Vora or Gorawara because

such zeolite is effective to remove oxygenates from a hydrocarbon feed. The Final Office Action argues that consequently, the modified process of Miller would produce an olefinic product comprising substantially no oxygenates as claimed because of the similarities between the claimed process and the modified process of Miller in terms of feedstock and adsorbent. Gorawara also discloses that the adsorbent is capable of producing a product containing less than 5 ppm of oxygenates, specifically acetone.

Claims 19-28 stand rejected as obvious over the same references applied against claims 1, 7-11, and 15-18, and further in view of U.S. Patent 6,395,948 (hereafter referred to as "Hope et al.") which teaches the use of specific ionic liquid oligomerization catalysts which may be employed to carry out Applicants' claimed invention.

The rejection of claims 1, 7-11, 15-18, and 19-28 under 35 U.S.C. 103(a) were essentially the same as in the two earlier non-final office actions. The arguments filed in Applicants' responses dated January 6, 2005 and May 12, 2005 were not found persuasive and a final office action was issued on September 12, 2005.

#### Summary of the Invention

Before considering the art rejections, it is believed that a brief review of the present invention will be helpful. Applicants' invention resides in the discovery that extremely small amounts of oxygenates in Fischer-Tropsch condensate will deactivate ionic liquid oligomerization catalysts which are used to oligomerize the olefins present in Fischer-Tropsch condensate. Fischer-Tropsch condensate generally boils in the range of naphtha and diesel. Diesel has a carbon number within the range of C<sub>8</sub> to C<sub>26</sub>. To Applicants' knowledge the discovery that oxygenates in very low concentration will deactivate ionic liquid catalysts has not been previously reported. As the problem was unknown in the art at the time the invention was made, then the

solution to that problem cannot be obvious. While it is well known to dehydrate alcohols to form olefins prior to oligomerization, there is no suggestion in the literature that extremely small amounts of other oxygenates which may be present in Fischer-Tropsch condensate will interfere with the oligomerization process when an ionic liquid catalyst is used. Therefore unlike processes taught in the prior art, Applicants' claimed process removes "substantially all" of the oxygenates present, including ketones, aldehydes, carboxylic acids, and anhydrides, not just the alcohols.

The Fischer-Tropsch condensate of Applicants' invention is unique from the hydrocarbons taught in the secondary references, and it would not be expected that the same catalysts would be effective at removing oxygenates from such different hydrocarbon feedstocks. A person skilled in the art would not expect that catalysts effective at removing oxygenates from C<sub>3</sub>-C<sub>5</sub> hydrocarbon streams used in downstream alkylation, isomerization and etherification processes toward the production of ethers used as gasoline octane improvers would also be effective at removing oxygenates from Fischer-Tropsch condensate used in oligomerization using an ionic liquid catalyst.

The Differences Between the Claimed Invention and the Miller et al.  
Reference

The primary reference cited by the Patent Office, Miller et al., describes a two step dimerization process for preparing lube base oil from olefinic feedstocks. In the first step a C<sub>5</sub>-C<sub>11</sub> (naphtha) olefinic feed is dimerized to a C<sub>10</sub>-C<sub>22</sub> intermediate product which in turn is dimerized in the second step to a product boiling in the base oil range. The first dimerization step is preferably carried out in a fixed bed reactor, such as a found in an MTBE or TAME plant. See column 9, lines 27-31. The preferred catalyst for carrying out both the first and second dimerization is a nickel ZSM-5 catalyst. See column 1, lines 40-

51. In column 1, lines 31-35, Miller et al. specifically states that the process disclosed in the reference is intended as a method for the production of lube base oil using a MTBE or TAME plant. None of this has anything to do with Applicants' claimed invention. Applicants' process uses a condensate feed having hydrocarbons boiling in the range of diesel, thus not requiring a two step process to produce base oil products.

Prior to Applicants' invention the necessity to remove "substantially all" of the oxygenates present in a Fischer-Tropsch condensate prior to oligomerization with an ionic liquid catalyst was not known. Miller et al. fails to appreciate, or even suggest, the need to remove "substantially all" of the oxygenates present in Fischer-Tropsch condensate prior to oligomerization, particularly when an ionic liquid oligomerization catalyst is utilized. Miller et al. teaches that feedstocks to an oligomerization process preferably do not contain an "appreciable amount" of oxygenates and/or other impurities that adversely affect the dimerization catalyst in column 3, line 67, to column 4, lines 1-4; and that the "appreciable amount" depends on the sensitive(sic.) of the particular catalyst used. Miller et al. describes the use of a purification zone prior to oligomerization in order to remove "oxygenates and other impurities" in column 5, lines 43-49. Methods mentioned for use in the purification zone include hydrotreating, dehydration, adsorption, and extraction. The only adsorbent for removing oxygenates mentioned in the reference is acid clay. Miller et al. gives no motivation to utilize a more effective adsorbent than acid clay to remove "substantially all" of the oxygenates and other impurities prior to oligomerization.

The dimerization steps described in Miller et al. are preferably carried out in a fixed bed reactor which, of course would not be suitable for use with an ionic liquid catalyst. The preferred oligomerization catalysts in Miller et al. are much less sensitive to deactivation by oxygenates, including ketones, aldehydes, and anhydrides. The preferred catalyst

used by Miller et al. is a nickel ZSM-5 catalyst although other solid catalysts are exemplified. The only mention of an ionic liquid catalyst is a single entry in column 9, lines 39 and 40 where they are mentioned as part of a catalogue of acid catalysts having dimerization activity.

According to the MPEP §2143, one of the criteria to establish *prima facie* obviousness is that the prior art reference (or references when combined) must teach or suggest all the claim limitations. There also must be some motivation to modify the reference or to combine reference teachings. As Miller et al. did not teach, suggest, or motivate a process for oligomerizing the olefins present in a Fischer-Tropsch derived condensate with the steps of: a) removing "substantially all" the oxygenates present in the Fischer-Tropsch condensate and b) contacting the Fischer-Tropsch derived condensate containing substantially no oxygenates with an ionic liquid catalyst in an oligomerization zone, a *prima facie* case of obviousness is respectfully traversed. The teaching or suggestion to make the claimed invention arises for the first time in Applicants' disclosure. The general description contained in Miller et al. certainly does not put the public in possession of Applicants' claimed invention nor would it suggest Applicants' claimed invention to one skilled in the art.

In order to overcome the deficiencies of Miller et al. the Office Action has combined the primary reference with the secondary references Vora et al., Gorawara et al., and Hope et al.

The Secondary References Vora et al. and Gorawara et al.

Both Vora et al. and Gorawara et al. describe processes for the production of ethers, principally MTBE or TAME, or alkylates. MTBE, TAME, and alkylates are significantly different products than what was being sought by the Applicants. Neither process remotely resembles the process claimed by Applicants for producing high quality lube base oils or diesel fuel. Nothing is

taught in either Vora et al. or Gorawara et al. relating to catalytic oligomerization processes. The feedstocks used in both references are cracked gasoline, the catalyst used is a solid supported alkylation, isomerization or etherification catalyst, and the products are ethers or alkylates. Neither Vora et al. nor Gorawara et al. are analogous art to Applicants' invention. The only relevance of these references to the present invention is that they teach that certain adsorbents, most particularly 13X zeolite, may be used to remove polar compounds from C<sub>3</sub>-C<sub>5</sub> hydrocarbon streams. The two references teach nothing about the oligomerization of olefins in general or the use of an ionic liquid oligomerization catalyst with Fischer-Tropsch condensate in particular. They certainly do not teach, suggest, or motivate a skilled person to recognize the importance of removing "substantially all" of the oxygenates present in a Fischer-Tropsch derived condensate containing a mixture of olefins and oxygenates prior to using an ionic liquid catalyst in an oligomerization process. As such, Vora et al. and Gorawara et al. fail to overcome the deficiencies of Miller et al.

The argument in the Final Office Action that the reason or motivation to modify the reference may often suggest what the inventor has done, but for a different purpose or to solve a different problem is respectfully disputed in this case. There is no showing of some objective teaching in the prior art or the knowledge generally available to one of ordinary skill in the art that would have led them to combine or modify Miller et al. with either Vora et al. or Gorawara et al. The nature of the problem to be solved was completely unknown and not anticipated prior to Applicants' invention. An invention which is a combination of old elements is unobvious if the old elements typically deal with different problems (CCPA 1942).

It is respectfully submitted, that there would be no basis for one skilled in the art to combine the teachings of Vora et al. or Gorawara et al. with that of Miller et al. without an understanding of the importance of removing "substantially all" of the oxygenates present in Fischer-

Tropsch condensate to prevent deactivation of ionic liquid oligomerization catalysts.

The Secondary Reference Hope et al.

Hope et al. teaches the importance of carrying out the polymerization of alpha olefins in the absence of a diluent, such as hexane, when producing a very high viscosity polyalphaolefin. This reference was cited in the Final Office Action as teaching the use of the specific ionic liquid catalyst which represents the preferred oligomerization catalyst used in Applicants' invention. However, as with Vora et al. and Gorawara et al., Hope et al. fails to overcome the deficiencies of Miller et al. Hope et al. does not even mention oxygenates or describe methods for their removal in his discussion.

Even when combined with Miller et al. or the other secondary references, Hope et al. does not teach, suggest, or motivate one skilled in the art to remove "substantially all" the oxygenates in a Fischer-Tropsch condensate prior to oligomerization with the specific ionic liquid catalyst used in Applicants' invention. This is not surprising, since the feed stocks employed in the process of Hope et al. are pure alpha olefins which would not contain any oxygenates, unlike the Fischer-Tropsch condensate of Applicants' invention. The mere fact that prior art references can be combined or modified does not render the resultant combination obvious unless the prior art also suggest the desirability of that combination. Until Applicants' tried using the ionic liquid catalysts of Hope et al. in an oligomerization process with Fischer-Tropsch condensate feed containing small levels of oxygenates, the problem of oligomerization catalyst inactivation was unknown. The problem that Applicants discovered was completely unexpected.

In addition, the processes of Miller et al. and Hope et al. are sufficiently different that even by picking and choosing among the various teachings of

the primary and secondary references, one skilled in the art would not be led to Applicants' invention.

It is respectfully submitted, that there would be no basis for one skilled in the art to combine the teachings of Hope et al. with that of Miller et al. Miller et al. only mentions ionic liquid oligomerization catalysts among a catalogue of different catalysts. Even when the references are combined, they do not teach, suggest, or motivate a person skilled in the art to obtain the process of Applicants' invention.

### Conclusion

Applicants have argued that Miller et al. fails to teach the essence of Applicants' invention in that the primary reference does not recognize the importance of removing "substantially all" of the oxygenates present from a Fischer-Tropsch condensate when the Fischer-Tropsch condensate is subsequently oligomerized using an ionic liquid catalyst. Prior to Applicants' invention the problem of extremely small amounts of oxygenates in Fischer-Tropsch derived condensate causing deactivation of olefin oligomerization ionic liquid catalysts was not known or anticipated.

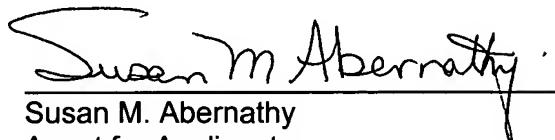
Applicants have argued that the process of Miller et al. and the problems being solved in the primary reference are different from the processes claimed and the problems addressed in the present case. Miller et al. is really nothing more than a catalogue of information which provides no basis for one skilled in the art to choose those teachings which are relevant to the present invention.

The secondary references, Vora et al. and Gorawara et al., describe adsorbents that are useful in carrying out Applicants' invention, but there is no reason of record for one skilled in the art to employ the adsorbents taught in the secondary references in the process of Miller et al. Likewise, Hope et al. fails to overcome the deficiencies of the primary reference. Even when

combined with Miller et al. or the other secondary references, Hope et al. does not teach, suggest, or motivate one skilled in the art to remove "substantially all" the oxygenates in a Fischer-Tropsch condensate prior to oligomerization with the specific ionic liquid catalyst used in Applicants' invention.

It is respectfully submitted that in view of the provided response, all of the claims remaining in the case are directed to patentable subject matter, and reconsideration for allowance is earnestly solicited.

Respectfully submitted,



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